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PROBLEM OF BROKEN AXLES IN CHINESE RR ACCIDENTS, IN 1949

In 1949, in the whole of China, there were 13 cases of broken axles. In the first 8 months of 1950, there were six cases in intramural China and one case in the Northeast. Most of them occurred on 30-ton gondola-type cars having special B-type axles, the kind provided by the bogus Manchurian government in accordance with the standards of the Association of American Railroads. In most cases the location of the trouble seemed to be in the contact surfaces of the wheel hub bore and the wheel seat of the axle, places which are not easily seen with the eye. What with low winter temperatures and the imposition of heavier loads upon defective equipment, such accidents are a serious matter and their causes ought to be carefully studied so that precautionary measures may be adopted.

A. Problems Involved

1. B-Type Axles

B-type axles have a low factor of safety. The original type of cars /with B-type axles/ had a tare weight of 13.5 tons and its regular load was 27.2 tons. In 1920, the metric system was adopted and the load was increased to 30 /metric/ tons. Later, steel was used for the car frames, thus increasing the tare weight to 14.5 tons. In 1939, the standard load was increased by 3 tons, in 1941 by 5 tons, in 1943 by 6 tons.

In March 1949, the Northeast Railway Administration officially announced that the loads to be carried by 30-ton and 40-ton cars was to be increased by 20 percent. This means that the loads have been progressively increased from 27.2 tons to 36 tons, or by 8.8 tons, with a resulting reduction in the factor of safety to the point of excessive fatigue and in some cases of breakdown.

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2. Unconsidered or Disguised Load Increments

This refers to such increments in load as the weight of water absorbed by goods in open cars unprotected by tarpaulins, water applied to wet down soft coal which may freeze and remain instead of draining off, water absorbed by cement and hardened cement from broken bags adhering to car floors, etc. Such unnoted increments contribute to the excessive loads that result in broken axles.

3. Special B-Type Wheel Axles

In 1935, during the Manchukuo regime, the Japanese in the Northeast built a large quantity of freight cars of which over 10,000 were equipped with special B-type wheel axles so designed that the wheels could be placed on the axles to run on 1,435 mm standard-gauge track, or on 1,524 mm wide-gauge track. In the former case, the wheel seat was 210 mm long; in the latter 195 mm long. Beside this, the plane of the center line of the tread and the plane of the center line of the wheel hub are not in the same vertical position. This results in bending strains greater than in the case of regular B-type axles.

4. Debased Quality of Material and Workmanship

While data is not at hand to go into this matter in detail, it is believed that the material and workmanship put into the wheels and axles manufactured in 1935 were inferior, due to the fact that Japan had subordinated civil production to military production.

5. Injuries and Improper Welding

Failure of axles, in at least four cases, is believed to have occurred as a result of gunfire or bombing, and to improper welding after deformation of axles had caused injurious internal strains.

6. Other Possible Causes

Other possible causes include: hot boxes, lax inspection, improper hot marking of axles, improper handling of axles, inaccurate marking of the load capacity of cars.

7. Conclusions

a. Hereafter, Soviet methods and design, embodying a larger factor of safety, should be used when manufacturing new car axles.

b. Increased or excessive loadings, overt or disguised, should be prohibited. The Ministry of Railways has issued orders concerning the former, but the latter type of overloading is still a serious matter. Cars should be marked with the standard tare weight, and this should be the true, not a fictitious, weight. The railroad should provide tarpaulins for use with open cars to prevent undesirable entrance and absorption of water.

c. Hereafter, chilled cast-iron treads to be fitted to special B-type wheels and axles should be made of greater cross sections. Cast-steel wheel centers of the standard type, with which China is well supplied, can still be used.

d. Axles, broken or damaged in 1949, should be sent to the laboratory for careful and thorough examination of chemical analysis, tensile strength, and hardness and a microscopic inspection made of the structure of the metal, as a basis for further study of the problem.

e. Apart from the axle collar, electric welding of axles should be prohibited. Random stamping of symbols or numbers on the body of the axles should be avoided.

f. A strict system of careful inspection of wheels and axles at time of accepting delivery of newly purchased stock should be established, as well as arrangements for routine control inspection and repair on the level of the ministry, bureau, shop and division.

g. At the division shops, inspection and repair equipment should be increased and improved. Included in this should be uniform standard inspection apparatus, and electromagnetic instruments for detecting subsurface defects.

h. Car inspectors should observe strictly a systematic method of inspection. Repairmen should strive to put all parts of the rolling stock in perfect condition to avoid improper abrasion or other damage to the wheels and axles.

i. It is inadvisable to use a combination of regular type and special type of wheels and axles on the same car.

j. The Ministry of Railways, or Railway Bureaus, should institute a plan for rewarding those who develop methods of preventing the occurrence of wheel-axle accidents.

B. Suggestions to Repairmen and Inspectors

The following suggestions are made to men working on wheels and axles.

1. Repairmen

a. Before installing wheel-axle assemblies to cars, they should just be given an external examination to ascertain positively whether or not there are any signs of metal fatigue or fine cracks; the electromagnetic internal defect detecting instrument should be used.

b. The wheel hub bore and the wheel seat (the part of the axle on which the wheel is seated) should be perfectly round and smooth. The diameter of the wheel seat should be from 0.10 to 0.35 mm larger than the diameter of the wheel-hub bore.

c. When working on the axle or forcing it into the wheel-hub bore, the surface of the wheel seat must not be scratched. The wheel seat should be greased with a mixture of white lead and castor bean oil.

d. The force required to press the axle into the wheel hub, for each 100-mm diameter of the wheel bore, is a maximum of 45 tons and minimum of 30 tons for wheels with a tire, and a minimum of 25 tons for solid wheels.

e. With the exception of the collar of the axle, no part of the axle should be electrically welded.

f. In making the regular routine external and careful examinations, the method of the Soviet adviser, T'zu-wei-lieh-fu [Chinese approximation of Russian name, possibly Zverlev] should be followed.

g. The standard axle inspection apparatus should be part of the equipment.

h. Inspections made when accepting delivery of newly acquired axles, and those that should be made in the course of assembly, should be more strict. The system of workmen's responsibility should be enforced.

1. The use of black-skin axles should be forbidden.

2. Inspectors

a. The system of using specially trained and experienced inspectors whose special responsibility is the inspection of wheels and axles should be employed.

b. The axle inspection apparatus should be up to standard, and an electromagnetic subsurface defect detection instrument should be available. (At present, some divisions are not supplied with this kind of equipment.)

c. All rules and regulations pertaining to standard operational inspections and repair methods should be observed strictly.

d. In inspection and repairs, the T'zu-wei-lieh-fu methods should be rigidly observed.

e. When axles show anything suspicious, no random filing, hammering, tapping or jarring should be permitted.

C. T'zu-wei-lieh-fu's Method of Inspection and Repair

1. Order

a. External examination, under operating conditions before the axle has been brushed off.

b. Make another external examiniation after the axle has been brushed off.

c. Use the electromagnetic testing apparatus for detecting subsurface defects.

d. Make a very careful examination.

2. Methods

a. How to judge the tightness or looseness of the axle. Is there any sign, at the place where the wheel seat and the hub bore come in contact, that oil or rust have penetrated, or that the lead paint layer on the wheel seat is broken, wrinkled, cracked, or flaked off? If there is suspicion that such is the case, try to ascertain to what extent this has taken place.

b. How to judge the condition of the surface of the bore of the wheel hub. At the place of contact with the axle, note damage to the layer of lead ent? (Note: When the lead paint layer is damaged, it may be due to rust of the axle, or to rust of the bore if there is a looseness, or to rust due to hair cracks in the wheel seat of the axle. These three conditions cannot be dealt with in the same manner, and it is necessary to relay on experience to judge which is the case).

c. Use a magnifying glass to see if, at the edge of the wheel seat, there are any fine wavy haircracks shaped like saw teeth.

d. Are there any scars on the surface of the wheel seat?

e. Is there any unevenness of space between the wheel seat and the hub bore?

f. Are there any extrusions of snake-like rings of grease and dust, or outwardly extending hair cracks?

g. Are there on the wheel seat any fine frost cracks due to freezing?

h. Is there any variation in the inside distance between wheel rims?

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